(12) UK Patent Application (19) GB (11) 2 377 438 (13) A

(43) Date of A Publication 15.01.2003

(21) Application No 0216089.3

(22) Date of Filing 11.07.2002

(30) Priority Data
(31) 10134198 (32) 13.07.2001 (33) DE

(71) Applicant(s)
Carl-Zeiss-Stiftung
(Incorporated in the Federal Republic of Germany)
Hattenbergstrasse 10, 55122 Mainz,
Federal Republic of Germany

(72) Inventor(s)
Hatto Schäfer
Christian Schenk
Horst Wolf
Andreas Walsdorf

(74) Agent and/or Address for Service
Potts, Kerr & Co
15 Hamilton Square, BIRKENHEAD,
Merseyside, CH41 6BR, United Kingdom

(51) INT CL[7]
C03B 19/10

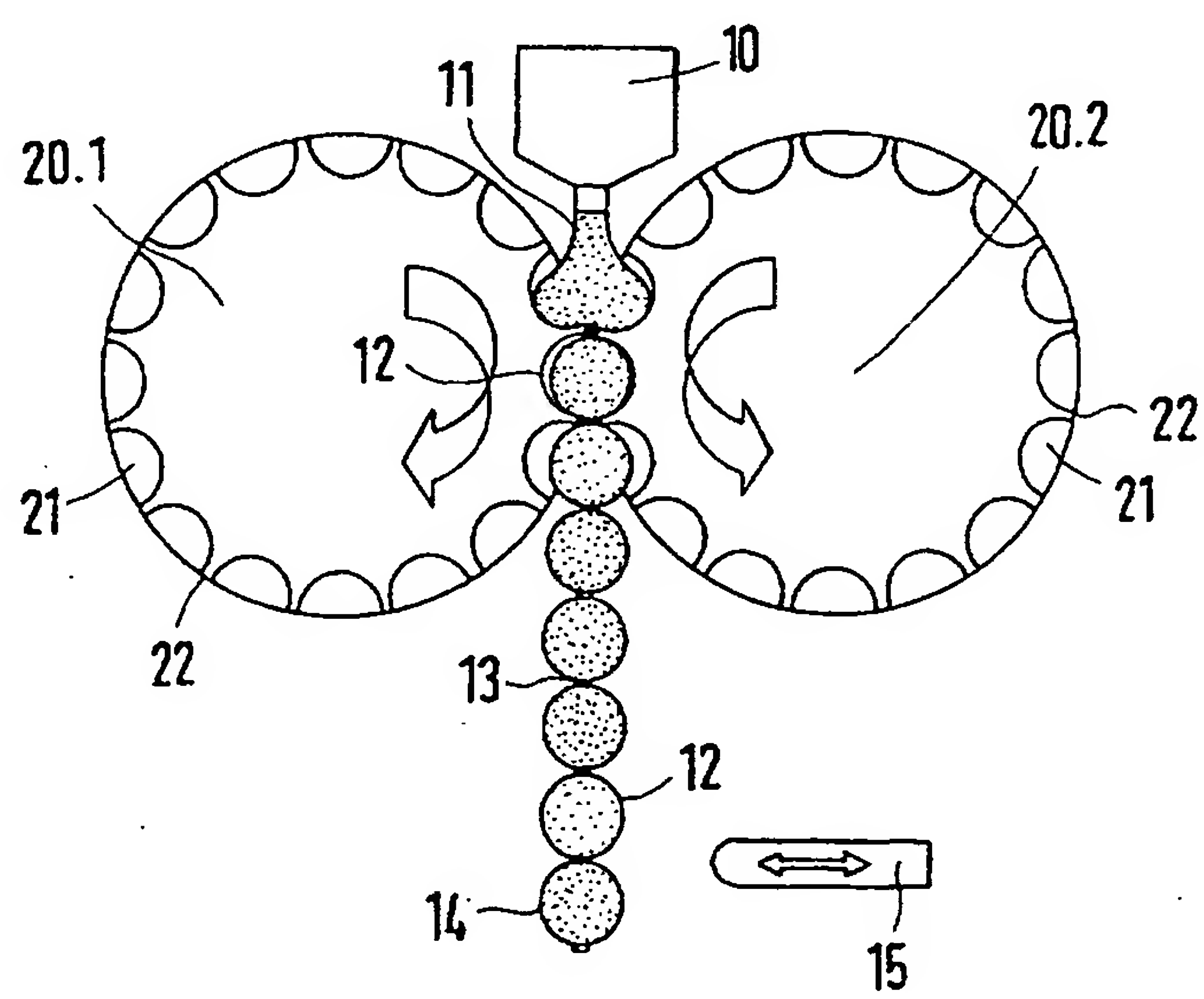
(52) UK CL (Edition V)
C1M MPB M440

(56) Documents Cited
DE 001082707 B

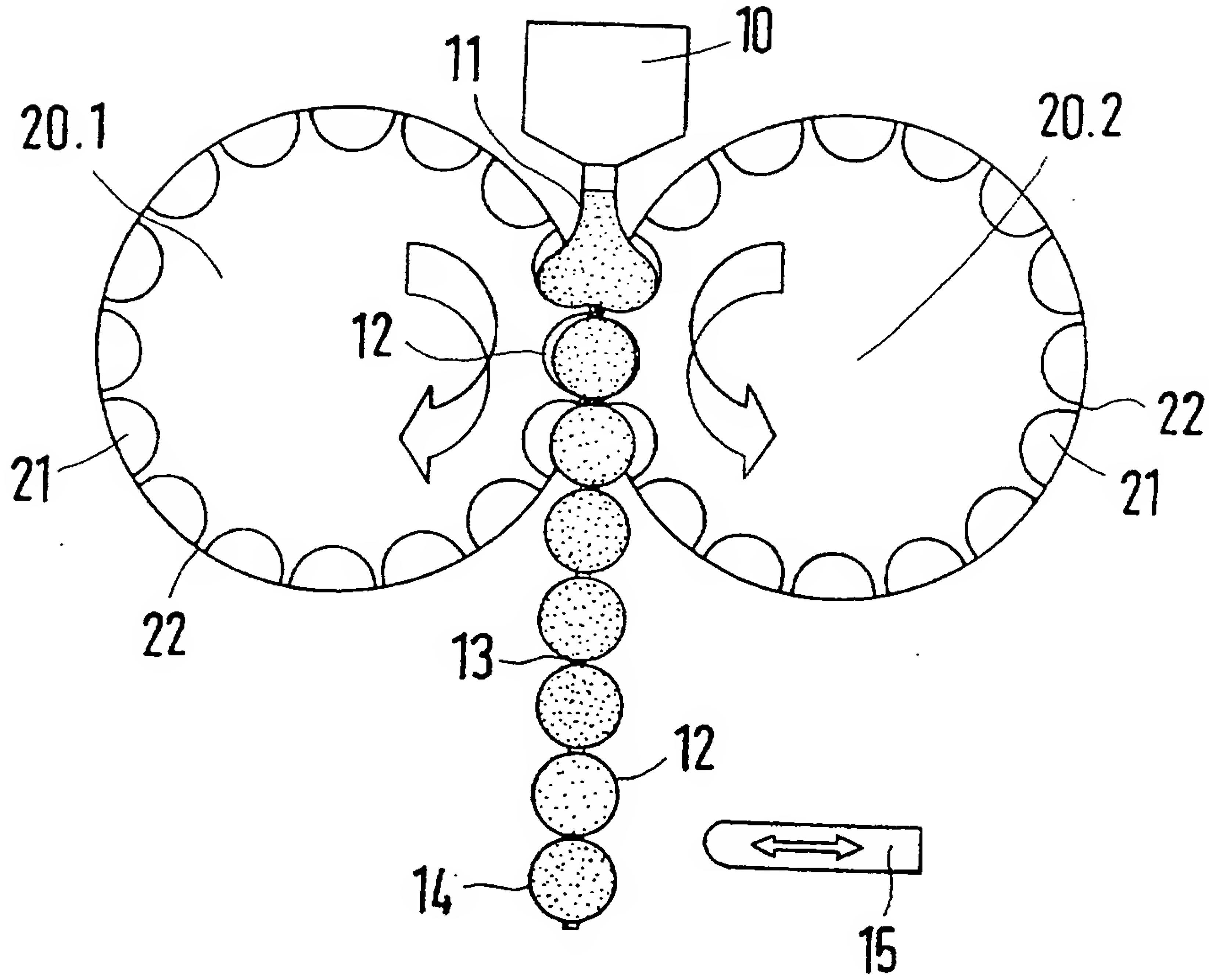
(58) Field of Search
UK CL (Edition T) **C1M** MPB
INT CL[7] **C03B** 19/10
Other: **ONLINE: WPI,EPODOC,JAPIO**

(54) Abstract Title
Producing glass balls

(57) A method of producing glass balls, comprises feeding a glass flow (11) between two rollers, (20.1,20.2) which are driven synchronously but contrarotatingly in the flow direction, from a feed tank (10) containing a mass of molten glass, said rollers having hemispherical depressions (21) distributed over the circumference and forming spherical beads (12) on a thin glass strip (13) successively in the region of an imaginary contact tangent, (the thickness of the glass strip being fixed by the spacing between the rollers externally of the depressions in the region of the contact tangent), separating the crude balls (14) from the glass strip by means of a separating device (15) once the glass strip (13), containing the spherical beads, has been cooled, and subjecting these crude balls (14) to a cold surface finishing treatment.



GB 2 377 438 A


10
11
20.1
20.2
12
22
21
21
22
13
12
14
15

METHOD AND APPARATUS FOR PRODUCING GLASS BALLS

The invention relates to a method and an apparatus for producing glass balls.

Known methods are very complex and, in consequence, incur high production costs. It is thus known to cut manageable pieces or pellets from a glass block and then to round them and rough-grind them in a drum. The crude balls thus produced are ground coarsely, ground finely, lapped and polished, i.e. they are subjected to a plurality of cold finishing treatments. The same disadvantages also exist when cylindrical portions are separated from glass rods as initial components.

When producing the glass rods, constrictions are made which are shaped to form balls. The strand of glass may also be severed by air pressure or by means of a rotating disc, so that small glass particles are sprayed or centrifuged, said particles being shaped to form balls by surface tension. In such case, however, the size of the balls being produced is already limited to a diameter range less than 1 mm.

An object of the invention is to provide a method of producing glass balls, whereby a plurality of crude balls, even those of a relatively large diameter, can be produced very easily.

This method is characterised, according to the invention, in that a glass flow is fed between two rollers, which are driven synchronously but contrarotatingly in the flow direction, from a feed tank containing a mass of molten glass, said rollers having hemispherically shaped depressions distributed over the circumference and forming spherical beads on a thin glass strip successively in the region of an imaginary contact tangent, in that the thickness of the glass strip

by the spacing between the rollers externally of the depressions in the ıf the contact tangent, in that crude balls are separated from the glass means of a separating device once the glass strip, containing the ꞉l beads, has been cooled, and in that these crude balls are subjected to ırface finishing treatment.

glass strip, containing the spherical beads, comprises a plurality of ꞉lls which, after being cooled, can easily be separated from the thin glass neans of a separating device, since the thin glass strip is in the form of led breaking location. In such case, the separation may be effected in a

case, it is important that the two rollers are driven synchronously and atingly, and that the depressions are so disposed on the roller casing are constantly aligned with one another in the region of the imaginary angent and form the spherical beads. It is necessary to prevent the ons, which encounter one another, from becoming offset from one on the circumferential side or axially, and this can be achieved in the way by driving the rollers in a correspondingly synchronously regulated Since the crude balls are obtained at relatively low cost, additional s prior to the cold finishing treatment are no longer necessary.

he crude balls can easily be separated from the glass strip, one ent makes provision for the glass strip, between the spherical beads, to orm of intended breaking locations having a thickness of about 1.5 mm. nicknesses no longer represent good intended breaking locations. In of smaller thicknesses, there is the danger that, during the separating cracks may also be formed in the region of the crude balls.

According to an additional embodiment, provision is made for the rollers to be heated-up to about 270 to 300° C by means of radiation heat.

This method avoids differences in temperature which are too great between the rollers and the glass strip containing the beads, and cracks are prevented from forming in the glass.

In the case where types of glass have low viscosity (short η development curve), one pair of rollers is generally sufficient for the drawing system, since the solidifying process and a sufficiently thin rolling-out process are concluded at roughly the same time. In the case of more viscous glass types (longer η development curve), these two mechanisms are not achieved with one pair of rollers. A cascade of rollers, having 2 to 3 pairs of rollers, is to be provided.

So that the glass flow travels uniformly along the rollers and enters the depressions, a further development makes provision for the glass flow to be supplied to the rollers from the feed tank with a temperature of between 1000 and 1200° C and a low viscosity of between 1 and 50 dPas, preferably about 10 dPas, at a throughflow rate of between 200 and 250 g/min. In the case of glasses which are too viscous, the glass strip, that is to say the intended breaking locations, cannot be rolled thinly enough.

So that the beads already assume as good a spherical configuration as possible, the diameter of the rollers can be selected to be between 100 and 250 mm, and the radius of the depressions can be selected to be between 3 and 10 mm.

In order to utilise in optimum manner the roller circumference for the formation of beads, one embodiment makes provision for rollers to be used, wherein the depressions are disposed in circumferential rows on the roller surfaces with

spacings therebetween, the adjacent circumferential rows being 'ed with each other so as to be offset from each other by half a spacing. :quence, the glass strip, as the intended breaking location and carrier of :rical beads, is limited to short lengths between the beads.

ratus for producing glass balls according to the method of the invention :terised in that a glass flow can be supplied from a feed tank, containing of molten glass, to a shaping device having two rollers, which are driven ously and contrarotatingly and have hemispherical depressions to form ss strip having spherical beads, in that, once the glass strip has cooled, ls are separable from the glass strip as crude balls by means of a g device, and in that the crude balls are then subjected to a cold surface treatment, the final cold finishing treatment being accomplishable in anner to the desired extent.

od and the apparatus according to the invention are explained more reference to one schematic drawing.

tank 10 of an apparatus may be, for example, the drawing container for system of a plate glass system, in which tank the mass of molten glass :d to the two contrarotatingly driven rollers 20.1 and 20.2 as glass flow outlet slot.

ces of the rollers 20.1 and 20.2 are provided with circumferential rows herical depressions 21, which are disposed at uniform spacings from er and are each separated from the other by circumferential regions 22 ers 20.1 and 20.2. A gap, which determines the thickness of the glass owing therethrough, therefore remains at the location with the smallest etween the rollers 20.1 and 20.2, which rotate in the flow direction of

the glass flow 11, i.e. at the ideal contact tangent, while the depressions 21 of the two rollers 20.1 and 20.1, which encounter one another when aligned in this region, form spherical beads 12 in this glass strip 13. In such case, the depressions 21, which extend into the narrowest zone, are initially filled with the glass flow 11, which is compressed to form the beads 12 as it passes the location with the gap. The gap is selected to be between 1.3 and 1.5 mm, and the glass flow 11 is conveyed through the rollers 20.1 and 20.2 with a temperature of between 1000 and 1200° C at a throughflow rate of 200 to 250 g/min. In such case, a mass of molten glass is used, which has a low viscosity of between 1 and 50 dPas, preferably of 10 dPas, and reliably accomplishes the filling process of the depressions 21.

The rollers 20.1 and 20.2 have a diameter of between 100 and 200 mm, and the depressions 21 have a radius of between 3.5 and 6 mm, when glass balls with a diameter of between 7 and 12 mm are produced. In order to prevent cracks from being formed in the beads 12, the rollers 20.1 and 20.2 are heated-up to between 270 and 350° C by means of radiation heat.

A plurality of circumferential rows of depressions 21 may be disposed in the axial direction, which are alternately offset from one another by half a spacing and interleaved with one another in order to obtain intended breaking locations which are as short as possible between the beads 12. The intended breaking locations are fixed by the thickness of the glass strip 13 and determined by the dimension of the gap between the rollers 20.1 and 20.2. In consequence, the glass strip 13 between the beads 12 should not be too thick, and even the smallest value is critical in order to prevent cracks from being formed in the crude balls 14 during the subsequent breaking-off of the crude balls 14 from the glass strip 13. After the cooling and hardening of the glass strip 13, containing the beads 12, the

on process is effected by means of a separating device, e.g. a drum or vely a hammer device.

de balls 14, thus obtained, are subjected to a cold surface finishing nt, for which purpose a coarse-grinding process, a fine-grinding process, g process and/or a polishing process may be accomplished depending esired surface finish.

CLAIMS

1. Method of producing glass balls, characterised in that a glass flow (11) is fed between two rollers (20.1; 20.2), which are driven synchronously but contrarotatingly in the flow direction, from a feed tank (10) containing a mass of molten glass, said rollers having hemispherical depressions (21) distributed over the circumference and forming spherical beads (12) on a thin glass strip (13) successively in the region of an imaginary contact tangent, in that the thickness of the glass strip (13) is fixed by the spacing between the rollers (20.1; 20.2) externally of the depressions (21) in the region of the contact tangent, in that crude balls (14) are separated from the glass strip (13) by means of a separating device once the glass strip (13), containing the spherical beads (12), has been cooled, and in that these crude balls (14) are subjected to a cold surface finishing treatment.

2. Method according to claim 1, characterised in that the glass strip (13), between the spherical beads (12), is in the form of intended breaking locations having a thickness of about 1.5 mm

3. Method according to claim 1 or 2, characterised in that the rollers (20.1; 20.2) are heated-up to about 270 to 300° C by means of radiation heat.

4. Method according to one of claims 1 to 3, characterised in that the glass flow (11) is supplied to the rollers (20.1; 20.2) from the feed tank (10) with a temperature of between 1000 and 1200° C and a low viscosity of between 1 and 50 dPas, preferably about 10 dPas, at a throughflow rate of between 200 and 250 g/min.

ethod according to one of claims 1 to 4, characterised in that the rollers :0.1; 20.2) having a diameter of between 100 and 250 mm are used, and ͻpressions having a radius of between 3 and 10 mm are used.

ethod according to one of claims 1 to 5, characterised in that rollers 0.1; 20.2) are used, wherein the depressions (21) are disposed in ·cumferential rows on the roller surfaces with uniform spacings erebetween, the adjacent circumferential rows being interleaved with ıch other so as to be offset from each other by half a spacing.

ıparatus for producing glass balls according to the method of the ʼention, characterised in that a glass flow (11) can be supplied from a ɔd tank (10), containing a mass of molten glass, to a shaping device ving two rollers (20.1; 20.2), which are driven synchronously and ntrarotatingly and have hemispherical depressions (21) to form a thin ıss strip (13) having spherical beads (12), in that, once the glass strip) has cooled, the beads (12) are separable from the glass strip (13) as ıde balls (14) by means of a separating device (15), and in that the de balls (14) are then subjected to a cold surface finishing treatment.

thod of producing glass balls substantially as hereinbefore described.

ɔaratus for producing glass balls substantially as hereinbefore ıcribed with reference to the accompanying drawing.

ss balls whenever produced in accordance with the method of at least m 1.

The Patent Office

INVESTOR IN PEOPLE

Application No: GB 0216089.3
Claims searched: 1-10

Examiner: Colin Clarke
Date of search: 30 October 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): C1M MPB

Int Cl (Ed.7): C03B 19/10

Other: ONLINE; WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	DE 1082707 B HUEBEL & SCHOELER see figure	1 & 7 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.